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TAXONOMY OF MENTZELIA MOLLIS AND ALLIED SPECIES (LOASACEAE)

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Mentzelia mollis Peck is a small annual endemic to the Succor Creek region in the Owyhee Desert of southeastern Oregon and southwestern Idaho. During a taxonomic and ecological study designed to clarify the relationship of *M. mollis* to other members of the genus, two poorly understood taxa came under investigation (Glad, 1975). One had been found in Leslie Gulch, a few kilometers west of Succor Creek, by Patricia L. Packard; the other had been noted in Colorado and Utah by Henry J. Thompson, who tentatively identified it as *M. mollis*. This paper reports conclusions reached concerning taxonomy of the three taxa.

Within *Mentzelia* sect. *Trachyphytum* T. & G., taxonomic interpretations are often difficult, because differences in morphology from one

species to another are subtle. There are at least two polyploid complexes, the *Mentzelia affinis* Greene complex and the *Mentzelia albicaulis* (Hook.) T. & G. complex; each has species that show wide morphological variations among their populations. However, these polyploid complexes can be separated from each other on the basis of seed morphology. It has long been noted that seed shape, marking, and surface texture are dependable taxonomic characters (Darlington, 1934), and recent workers have emphasized seed morphology as a basis for separating species (Thompson and Roberts, 1974). Other characters that are used to distinguish species are petal, bract, and leaf shape, petal color, and capsule shape and orientation (Zavortink, 1966). In the present study, reliance has been placed on these morphological features, since it has not been feasible to apply the ultimate species criterion of genetic compatibility via hybridization experiments (cf. Thompson and Roberts, 1971). Ecological data for *M. mollis* and its allied taxa proved to be of additional interest, however. Herbarium records by earlier collectors rather consistently refer to the occurrence of *M. mollis* on grey or green clay soil. This suggestion of an edaphic restriction was confirmed for all populations studied, and this factor, together with geographical isolation, appears to contribute to the variation pattern and endemism of these species.

Ecological Observations

Both *M. mollis* and the Leslie Gulch *Mentzelia* are found only on green or grey montmorillonite derived from the Sucker Creek formation, a tuffaceous sedimentary rock (Baldwin, 1964). In all instances both taxa were members of depauperate plant communities that did not include the common shrubs (*Atriplex* and *Artemisia* spp.) and grass (*Bromus tectorum* L.) that are ubiquitous in the Owyhee Desert. *Mentzelia mollis* consistently is associated with the same three species: *Cleomella macbrideana* Pays., *Phacelia lutea* (H. & A.) J. T. Howell, and *Monolepis pusilla* Torr. In no instance was the population of *M. mollis* contiguous with the *Artemisia-Bromus* community. The Leslie Gulch *Mentzelia* was found at the base of talus slopes that supported only scattered *Artemisia* and very sparse grasses and forbs. Soil samples were taken at a population of *M. mollis* near Rockville, Oregon, and from one site in Leslie Gulch. The former showed 1,360 ppm of potassium, the latter 6,400 ppm, both extraordinarily high concentrations. Although alkaline soil is common in this area of low rainfall, the potassium content of the soil that supports these populations could well account for both the exclusion of the normal *Artemisia*-dominated vegetation and the apparent edaphic endemism of the Mentzelias.

No data are available concerning plant associates of the Colorado-Utah *Mentzelia*. Information from specimens examined indicates that it, too, shows soil specificity, with Mancos shales, grey clay, and gumbo having been noted as substrates.

Morphological Comparisons

Despite their apparent similarity in floral morphology and soil specificity, *M. mollis* and the Leslie Gulch *Mentzelia* show rather marked morphological differences. *Mentzelia mollis* is relatively stout and many-branched, having ovate-lanceolate leaves with entire margins, sparse pubescence, obovate and mucronate petals, a style that is longer than the stamens, and very small, irregularly angled or rounded seeds that are minutely and finely papillose. It is tetraploid, $2n = 36$ (Ore., Malheur Co., *Glad 74–65,* OCS, and *Packard 74–37,* CIC). The Leslie Gulch *Mentzelia,* on the other hand, is only sparsely branched, has linear to ovate-lanceolate leaves, often with narrow, shallow lobes, dense pubescence, obovate to round petals, a style that is equal to or shorter than the stamens, and rather large irregularly angled to somewhat prismatic seeds with large, truncate papillae. It is octoploid, $2n = 72$ (type collection, see below).

The Colorado-Utah *Mentzelia,* seen only as herbarium specimens, is remarkably similar to *M. mollis,* differing primarily in floral size and morphology. The seeds are larger, with easily observed pointed papillae.

Both Oregon taxa show considerable vegetative and floral variation among populations and among individuals maturing at different times in the season; the most dependable taxonomic character to distinguish between them is seed morphology. A scanning electron microscope was used to photograph seeds of these two taxa, as well as of the Colorado and Utah specimens that closely resemble *M. mollis* in all but floral morphology. Three other species of sect. *Trachyphytum* (*Mentzelia dispersa* S. Wats., *M. albicaulis,* and *M. affinis*) were also examined.

The resulting comparisons (figs. 1 and 2) show certain distinctive differences in seed morphology. Both *M. affinis* (fig. 1, A and B) and *M. dispersa* (fig. 1, C and D) have obviously prismatic seeds, grooved on the angles. This is, in fact, the basis of separation of these two species from other members of sect. *Trachyphytum* (Thompson and Roberts, 1974). The papillae are low, truncate columns, closely set and relatively small as compared to those of other species in the section. Though nearly all other species have occasional seeds that are somewhat triangular in cross section, it is only in these two species that this characteristic is constant. *Mentzelia albicaulis* seeds (fig. 1, E and F) show the most marked differences from those of the preceding two species. They are often sharply, though irregularly, angled, never prismatic, and the papillae are high, pointed, and large in relation to seed size.

Of the three taxa under discussion, seeds of the Colorado and Utah *Mentzelia* (fig. 2, A and B) most closely resemble those of *M. albicaulis* in being irregularly angled and having high, pointed papillae. The Leslie Gulch specimen (fig. 2, C and D) has large but low truncate papillae whose flat tops have a textured concavity. While occasionally somewhat prismatic and grooved on the angles, they are more often irregularly angled or rounded. They are also among the largest seeds found in this

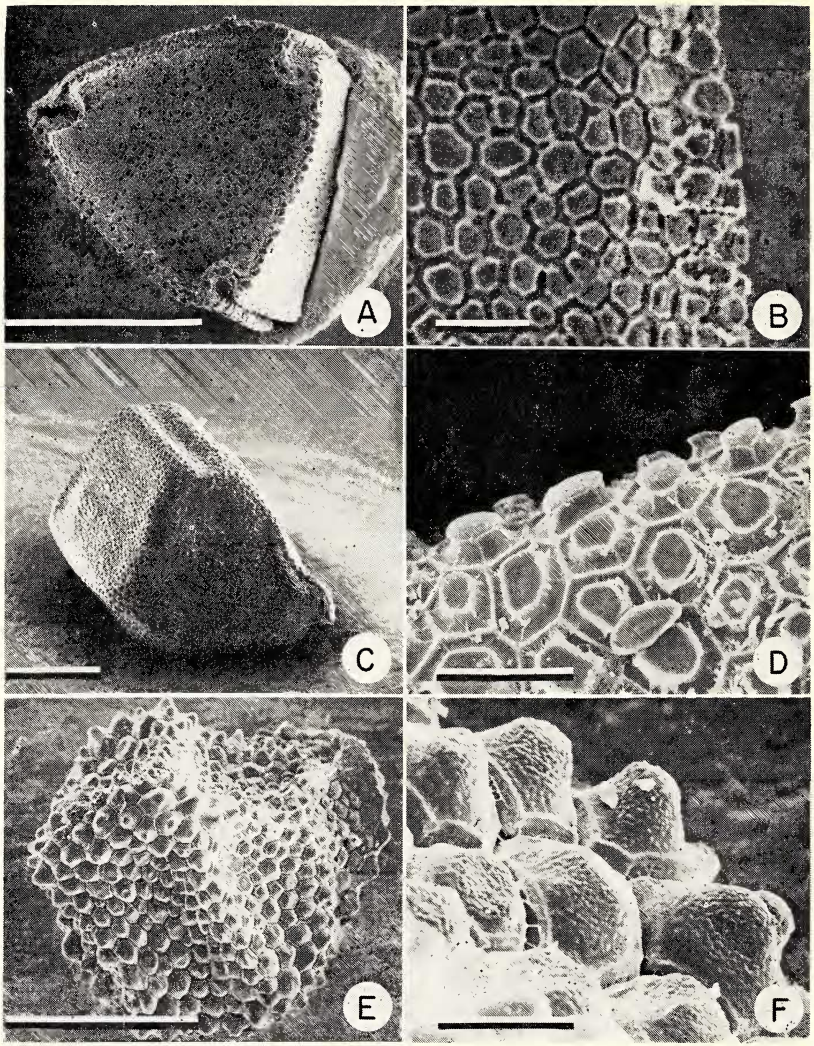

Fig. 1. Scanning electronmicrographs of seeds of *Mentzelia* spp. A and B, *M. affinis* (Calif., Kern Co., *Thompson 1557,* LA); C and D, *M. dispersa* (Ore., Harney Co., *Cronquist 8610,* LA); E and F, *M. albicaulis* (Ore., Harney Co., *Brown and Conrad EC042,* OSC). Scales: A, C, and E = 0.5mm; B, D, and F = 0.05mm.

group of species. At low magnification, seeds of *M. mollis* (fig. 2, E and F) appear to be quite smooth. Their shape is similar to that of other species in this group, but they are usually more rounded than seeds of either *M. albicaulis* or the *Mentzelia* from Colorado and Utah. Even at a magnification of 700×, the papillae are very small, low, and rounded, showing, incidentally, that the specific epithet may be applied to seed surface as well as to leaf pubescence.

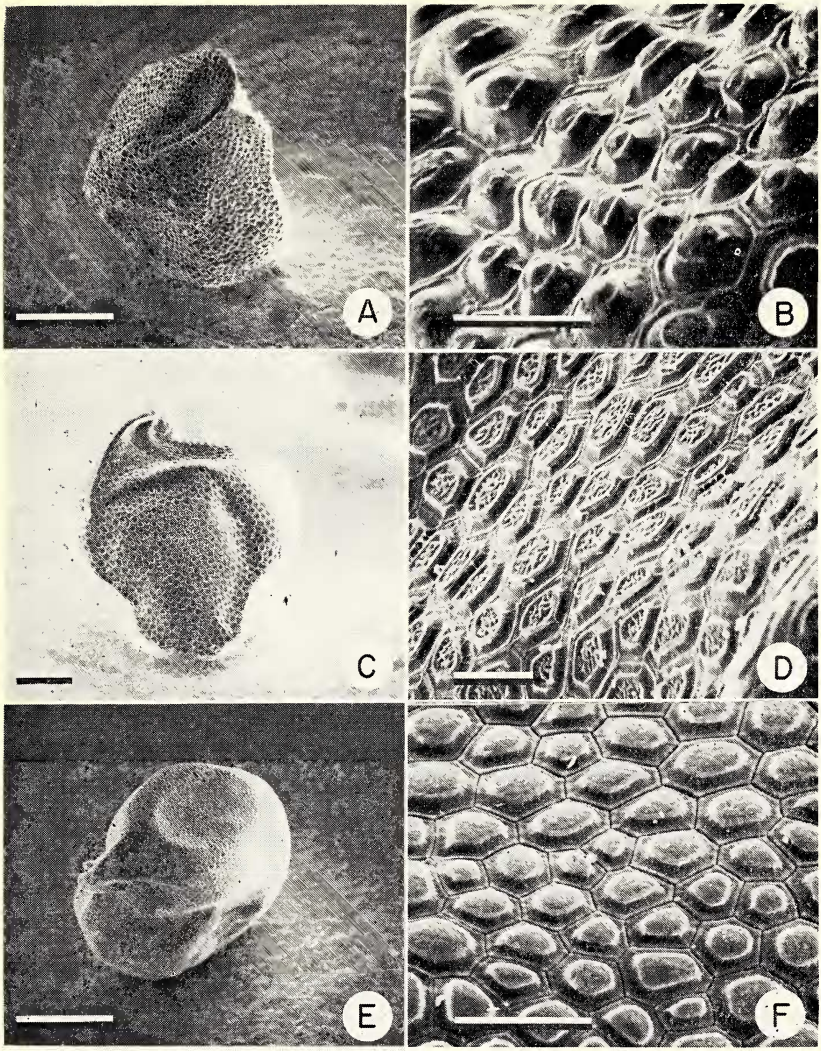

FIG. 2. Scanning electronmicrographs of seeds of *Mentzelia* spp. A and B, *M. thompsonii* (Colo., Montezuma Co., *Thompson 3540,* OSC); C and D, *M. parkardiae* (Ore., Malheur Co., *Glad 74–134,* OSC); E and F, *M. mollis* (Ore., Malheur Co., *Glad 74–116,* OSC). Scales: A, C, and E = 0.5mm; B, D, and F = 0.05mm.

TAXONOMIC CONCLUSIONS

Mentzelia mollis and the plants occurring in Leslie Gulch appear to represent two specifically distinct taxa, although they are only slightly separated geographically (fig. 3) and have superficially similar edaphic adaptations. Consistent and significant differences are seen in their chromosome numbers, as well as their vegetative, floral, and seed morphology. The chromosome difference might well act as a barrier to

successful interbreeding should any of the populations become sympatric. The *Mentzelia* from Colorado and Utah is disjunct geographically from the above two, and its range is not so localized (fig. 4). Although similar to *M. mollis* in habit and leaf shape, it has smaller petals that are obovate and retuse, and its seeds are distinctly papillose. It is proposed that these populations, too, be designated as a separate species. Future field studies of this plant, including chromosome counts and habitat descriptions, should tell more about its relationship to the taxa from the Succor Creek region.

Partial Key to Mentzelia sect. Trachyphytum
(modified from Thompson and Roberts, 1974)

1. Seeds angular or prismatic, regularly grooved along the three angles, surface appearing smooth at low magnification: . . . . . *M. affinis* complex
1. Seeds irregularly angled or rounded, not regularly grooved on the angles, surface generally appearing papillose at low magnification: *M. albicaulis* complex . . 2

2. Bracts lobed 3
2. Bracts entire 4

3. Bracts without white area at base . . *M. albicaulis* (in part)
3. Bracts with white area at the base . . *M. gracilenta* and allies

4. At least the oldest capsules recurved more than 90° *M. desertorum* and allies
4. None of the capsules recurved more than 90° 5

5. Rosette absent or loosely formed, basal leaves entire to scarcely lobed, upper leaves entire 6
5. Rosette present; basal leaves entire or with short or long irregularly toothed lobes 8

6. Leaves linear to linear-lanceolate, the lower sometimes with a few shallow lobes; branching sparse; seeds with low, truncate, microscopically reticulated papillae . *M. packardiae*
6. Leaves lanceolate to oblanceolate, entire; branching profuse; seeds with pointed or smoothly rounded papillae . . 7

7. Petals 6–15 mm, the apex mucronate; seed surface almost smooth, the papillae small, low, and slightly rounded . . . . . *M. mollis*
7. Petals less than 6 mm, the apex retuse; seed surface with high pointed papillae . . . . . *M. thompsonii*

8. Upper leaves broad-based, somewhat clasping; petals obovate or broadly ovate . . . . . *M. mojavensis*
8. Upper leaves not clasping, often entire; petals ovate *M. albicaulis* (in part)

Mentzelia packardiae Glad, sp. nov. Herba annua erecta 1–4 dm alta, caule parce ramoso crasso argento vel viridulo. Folia rosulae linearia integra aut lobata lobis angustis brevibus, caulis sessilia varie lineari aut ovato-lanceolata integra. Flores axillares solitarii nudi necnon in fasciculis terminalibus bracteis subtendi, bracteis sessilibus oblanceolatis integris amplectentibus. Sepala triangularia. Petala 5, 8–15 mm longa, lutea emaculata vel basi macula crocea, obovata vel rotunda, mucronata vel leviter retusa. Stamina 15–30. Stylus 4–10 mm longus, staminibus aequatus vel brevior. Capsulae axillares erectae cylindricae basi contractae 15–30 mm longae. Semina irregulariter angulata vel aliquantum prismatica brunneola interdum maculis atro-brunneis papillis numerosis humilibus truncatis.

TYPE: Oregon, Malheur County, Leslie Gulch 3.2 km southeast of Owyhee Reservoir, in green rock derived from the Sucker Creek Formation at base of talus slope, T25S, R44E, 26 June 1974, *Glad 74–76,* (Holotype: OSC!; isotypes: CIC!, NY!, LA!).

Plant annual, erect, 1–4 dm tall, sparsely branched, stems rather stout, white to pale green; basal leaves linear, entire, or with shallow narrow lobes; upper leaves linear to ovate-lanceolate, entire, sessile, and occasionally somewhat clasping; flowers solitary in the stem axils, and in terminal clusters subtended by bracts; bracts sessile, oblanceolate, entire, and somewhat clasping; sepals 5, triangular, about one-third as broad as long, recurved and persistent on the mature capsule; petals 5, 8–15 mm long, yellow, with or without an orange spot at the base, ovate to round, mucronate or slightly retuse; stamens 15–30, 4–10 mm long; style 4–10 mm long, equal to or shorter than the stamens; capsules erect, cylindrical, tapering slightly toward the base, the axillary capsules 15–30 mm long, the terminal capsules 8–25 mm long; seeds 10–20 per capsule, irregularly angled to slightly prismatic, sometimes with shallow grooves on the angles, brownish and sometimes with darker brown spots, 2.0 mm long and 1.5 mm wide, the surface with low, truncate papillae; chromosome number $2n=72$.

DISTRIBUTION (fig. 3): In rocky soil of high montmorillonite content at base of talus slopes along canyon walls, Leslie Gulch and its side canyons, Malheur County, Oregon, only.

Mentzelia thompsonii Glad, sp. nov. Herba annua erecta, 1–2 dm alta, ramosa caulibus confertis pallidis. Folia sessilia ovato-lanceolata integra. Flores axillares solitarii nudi necnon in fascicularis terminalibus bracteis subtendi, bracteis sessilibus oblanceolatis integris amplectentibus. Sepala triangularia. Petala 5, 1.5–4.0 mm longa, lutea obovata apice retusa. Stylus 1.5–3.0 mm longus, staminibus aequatus vel brevior. Capsulae axillares erectae cylindricae, 12–20 mm longae. Semina irregulariter angulata papillis numerosis acutis vel truncatis.

TYPE: Colorado, Montrose County, gypsum hills 7 miles east of Montrose, 6,000 feet, 30 May 1952, *W. A. Weber 7470* (Holotype: COLO!; isotypes: RSA!, WTU!, WS!).

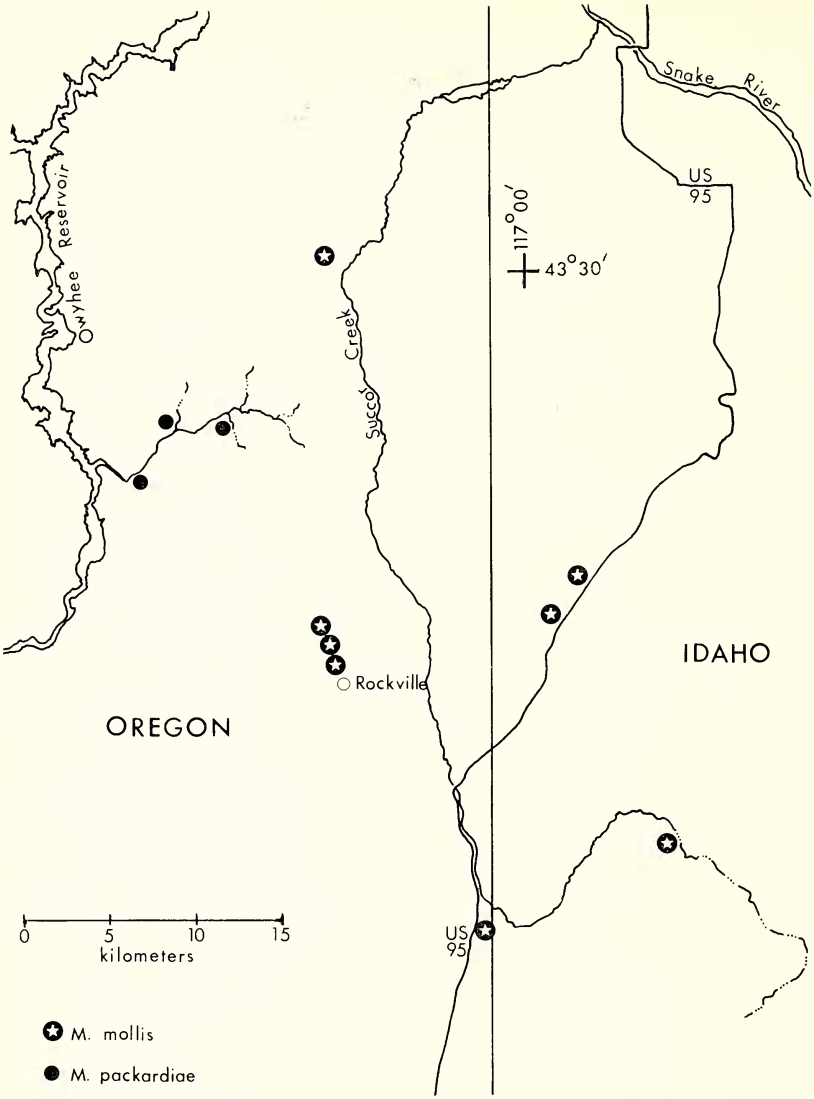

Fig. 3. Distribution of *Mentzelia mollis* and *M. parkardiae*.

Plant annual, erect 1–2 dm tall, moderately branched and compact, the stems pale; leaves ovate-lanceolate, entire, sessile; flowers solitary in the stem axils and terminal, subtended by bracts; bracts oblanceolate, green, entire and somewhat clasping; sepals 5, triangular; petals 5, 1.5–4.0 mm long, yellow, obovate, the apex retuse; style 1.5–3.0 mm long, equal to or shorter than the stamens; capsules erect, cylindrical, narrowing slightly at the base, the axillary capsules 12–20 mm long, the

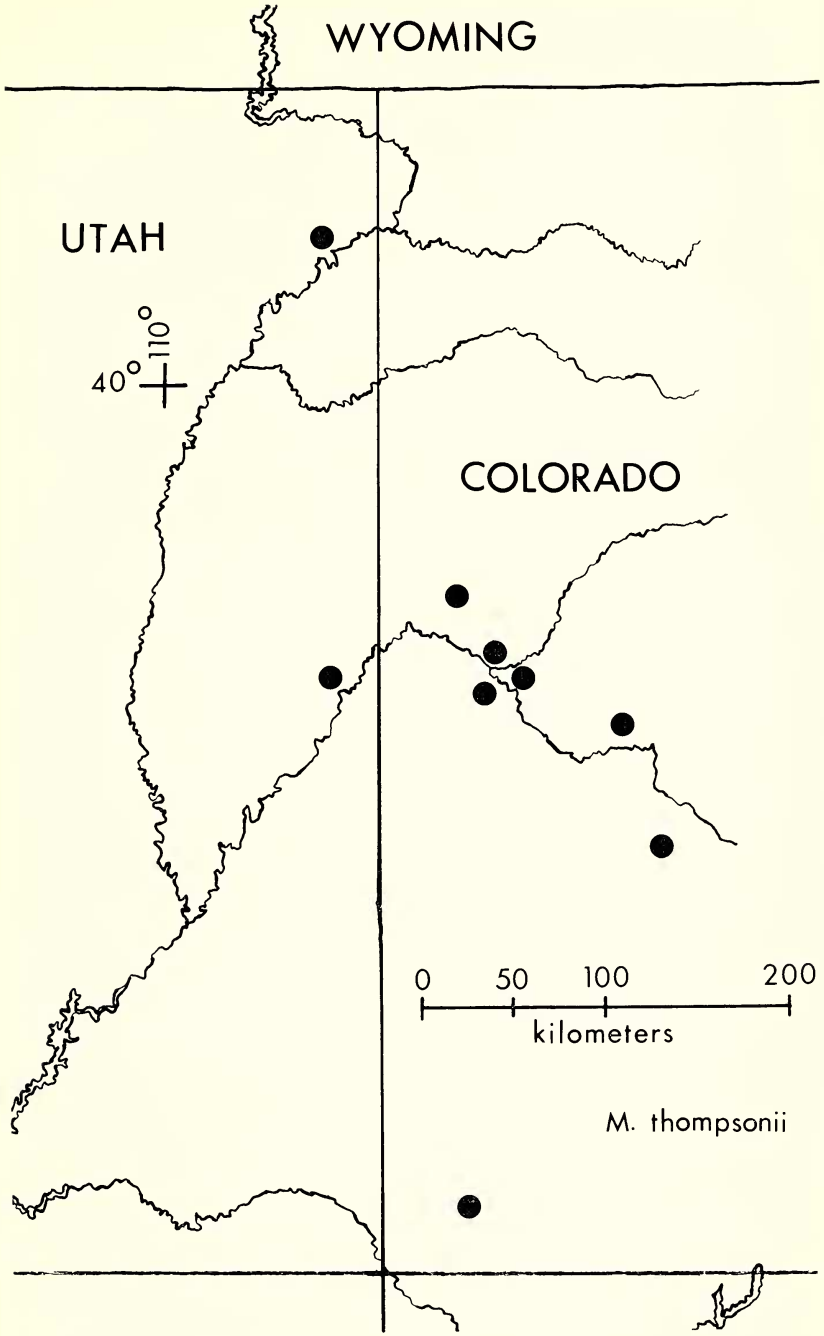

FIG. 4. Distribution of *Mentzelia thompsonii*.

terminal capsules 5–15 mm long; seeds 10–25 per capsule, irregularly angled, 1.2 mm long by 0.8 mm wide, the surface with small pointed to truncate papillae.

Distribution (fig. 4): On grey clay of high desert hills along the Utah-Colorado border, 1200 to 1800 m.

Flowering time for both species is mid-May to late June. *Mentzelia thompsonii* has been identified both as *M. mollis* and *M. dispersa* in the past, but it is morphologically very different from both.

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A NEW SPECIES OF CHOLLA (CACTACEAE: OPUNTIA) FROM COAHUILA, MÉXICO

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A floristic study of the Bolsón of Cuatro Ciénegas and surrounding mountains, Coahuila, México, has revealed a new species of cholla (Cactaceae: *Opuntia* subg. *Cylindropuntia*). It was first found growing on an open, gently sloping, south-facing bajada near the base of Mt. Anteojo of the Sierra de la Madera. Additional collections have extended the range to three other contiguous basins to the west and south.